REMARKS

Claims 1-20 are all the claims pending in the application. Claims 8-10 and 18 are withdrawn as being directed to a non-elected species. Claims 21-22 were previously canceled.

Reconsideration and review of the claims on the merits are respectfully requested.

Formal Matters

Applicant notes with appreciation that the proposed drawing corrections filed October 25, 2002 have been approved. Applicant submits herewith six replacement sheets incorporating the approved drawing corrections.

Claim Rejections - 35 U.S.C. § 112

Claims 1-7, 11-17, 19, and 20 were rejected under 35 U.S.C. §112, second paragraph, as being indefinite with respect to the language "the surface of the region other than the projective region" and "the surface of the group-III nitride crystal layer", as recited in claims 1, 11 and 19, as lacking antecedent basis.

Applicant responds as follows.

In response, Claims 1, 11 and 19 have been amended to replace "the surface" with "a surface" and "the region" with "a region" as suggested by the Examiner. Entry of the amendment and withdrawal of the foregoing rejection under 35 U.S.C. § 112, second paragraph, is respectfully requested.

Claim Rejections - 35 U.S.C. § 103(a)

(A). Claims 1-3 and 6, 7 were rejected under 35 U.S.C. §103(a) as being unpatentable over Ming-Jiunn et al. (US 6,078,064) in view of Ohba et al. (US 5,076,860), Lee et al. (US 5,789,768), and Okazaki et al (US 5,977,566). Lee et al is newly cited.

Regarding independent claim 1, the Examiner acknowledges that Ming-Jiunn and Ohba do not teach that the second conduction-type surface ohmic electrode is disposed on a region other than the projective region and that the window layer covers and is in contact with the surface of the group-III crystal layer on the entire projective region of the pad electrode. However, the Examiner now cites Lee as making up for Ming-Jiunn and Ohba's deficiency.

Furthermore, the Examiner modifies his specific citations to Okazaki. The Examiner acknowledges that Ming-Jiunn, Ohba, and Lee do not teach that the second conduction type-surface ohmic electrode is comprised of a plurality of electrodes. However, the Examiner now cites Okazaki as teaching, in Fig. 4, Fig. 5(e), column 6, lines 6-9, and column 7, lines 57-58, a second conduction-type surface ohmic electrode (45) composed of a plurality of electrodes which are disposed on a surface of a region other than the projective region of the pad electrode on a group III nitride crystal layer.

The Examiner further cites to Okazaki at Fig. 4, Fig. 5(e), column 6, lines 6-9, and column 7, lines 57-58, as teaching the features of dependent claims 2, 3, 6 and 7.

Applicant respectfully traverses the obviousness rejection.

Fig. 5(e) of Okazaki et al shows metal agent layers 45, perhaps equivalent to the claimed second conduction-type surface element electrodes, disposed on the surface of the region other

than the projective region of the pad electrode 43. However, metal agent layers 45 are not in contact with the surface of the group -III nitride crystal layer as required by the rejected claims, but rather contact AlGaInP cladding layer 39 via p-GaAs contact layer 41. Differing from the light-emitting diode of the invention, at least some of the forward current in the device in Fig. 5(e) of Okazaki et al is spread underneath pad electrode 43 and the prior art device therefore lacks the efficiency of the claimed light-emitting diode where surface element electrodes 308 are in direct contact with upper clad layer 305 (see Fig. 3 of the present specification). Another difference is that in Okazaki et al, transparent conductive layer 47 does not cover and is not in contact with the surface of a group -III nitride crystal layer on the entire projective region of the pad electrode as required by the rejected claims. Rather, in Fig. 5(e) of Okazaki et al, transparent conductive layer 47 simply covers the top surface of metal agent layers 45, and does not cover the surface of AlGaInP cladding layer 39 on the entire projective region on the pad electrode 43, and is not in contact with the surface of AlGiInP cladding layer 39.

Therefore, the combination of Okazaki et al with Ming-Jiunn et al would not achieve the claimed light-emitting diode of the present invention.

Although Lee is cited as assertedly teaching a second conduction-type surface ohmic electrode (58) disposed on the surface of a region other than a projective region of the pad electrode on a group-III crystal layer, and a window layer covering and in contact with the surface of the group-Ill crystal layer on the entire projective region of the pad electrode, Lee is very different from at least the primary reference to Ming-Jiunn. In Fig. 5A, Lee discloses both a conductive transparent oxide layer (60), such as made of ITO, as well as a separate p-type,

transparent window layer (56), such as made of GaP (See Lee, col. 4, lines 34-40 and 59-61), whereas in Ming-Jiunn et al (Fig. 7), p-type electrode 42 directly contacts clad layer 13 without an intervening transparent window layer.

Lee et al Fig. 5A differs from the claimed light-emitting diode in that surface conductive electrodes 58 do not contact the surface of a group -III nitride crystal layer as required by the rejected claims, but rather contact top cladding layer 544 via p-type window layer 56. Also, window layer 60 of Lee et al is not in contact with the surface of a group-III nitride crystal layer as required by the rejected claims, but rather contacts top cladding layer 544 via second window layer 56. Moreover, although Lee et al describes that window layer 56 improves the illuminance efficiency of the LED (column 4, lines 38-41), it seems in fact that window layer 56 allows the forward current to be distributed underneath the projected area of pad electrode 62, to thereby result in a loss of emitted light, especially with respect to the periphery of the device. For example, as discussed at page 12, lines 13-19 of the specification, window layer 306 allows efficient ejection of emitted light to the outside, and, at the same time, has the capability of supplying a device operating current to the surface element electrode 38. So this object of the invention is defeated by interposing a window layer 56 as taught by Lee et al. Thus, the combination of Lee et al with any of Ming-Jiunn et al and Okazaki et al would also not arrive at the invention.

Lee et al, as noted by the Examiner, forms a Shottky barrier at the interface between the conductive transparent oxide layer 60 and the window layer 56 in order to block current underneath contact (pad) 62 (i.e., to mitigate against the current-spreading effect of window layer

56 over the entire surface of the LED). This would seem to suggest arrangement of surface electrodes at a position other than the projective region of the pad electrode. See column 4, line 59-column 5, line 20 of Lee et al. However, that same disclosure also shows that window layer 56 is essential in Lee et al, and that portions thereof cannot be arbitrarily used to modify the primary reference without also utilizing window layer 56.

The sectional view of FIG. 5A of Lee et al. resembles Fig. 3 of the present specification. However, although the interface of layer 60 and layer 56 of Lee et al. forms a Shottky barrier, layer 306 and layer 305 of the present specification do not. That is, layer 58 of Lee et al. is such that only partial current flows to layer 56 (see col. 4, lines 52-55 of Lee et al.). On the other hand, layer 308 of the present invention homogeneously diffuses the current which flows to layer 305 (See page 14, lines 19-22).

Accordingly, Applicant respectfully requests reconsideration and withdrawal of the rejection under 35 U.S.C. § 103(a).

(B). In Paragraph 7 at page 6 of the Office Action, the Examiner rejects claims 4 and 5 under 35 U.S.C. §103 (a) as being unpatentable over Ming-Jiunn, Ohba, Lee, and Okazaki as applied to Claim 1 above, and further in view of Bastek (US 4,232,440).

The Examiner cites Fig. 3 of Bastek as teaching second conduction-type surface ohmic electrodes (16) disposed at isometric positions from the center of a pad electrode (15).

Applicant respectfully traverses the rejection.

Applicant submits that Bastek is not combinable with the other references to render obvious the present invention. Bastek discloses multiple small contacts arrayed uniformly by deposition (See Bastek, 51-57). However, Bastek also teaches that all of the small contacts not covered by the bonding pad are to be entirely removed by sputter etching (See claim 1, step (4)). Therefore, Bastek's teaching is opposite to the requirement of the present invention having second conduction-type surface ohmic electrodes not under the projective region of the pad electrode.

Accordingly, Applicant respectfully requests reconsideration and withdrawal of the rejection under 35 U.S.C. § 103(a).

(C). Claims 11-13, 16, 17, 19, and 20 are rejected under 35 U.S.C. §103(a) as being unpatentable over Ming-Jiunn in view of Lee and Okazaki.

Applicant relies on the response above with respect to the rejection over Ming-Jiunn in view of Ohba, Lee and Okazaki.

Withdrawal of the rejection under 35 U.S.C. § 103(a) is respectfully requested.

(D). Claims 14 and 15 are rejected under 35 U.S.C. §103(a) as being unpatentable over Ming-Jiunn, Lee, and Okazaki as applied to Claim 11 above, and further in view of Bastek.

Applicant relies on the response above with request to the rejection over Ming-Jiunn in view of Ohba, Lee and Okazaki.

Withdrawal is respectfully requested.

Conclusion

In view of the above, reconsideration and allowance of this application are now believed to be in order, and such actions are hereby solicited. If any points remain in issue which the Examiner feels may be best resolved through a personal or telephone interview, the Examiner is kindly requested to contact the undersigned at the telephone number listed below.

Withdrawal of all rejections and allowance of claims 1-20 is certainly solicited.

The USPTO is directed and authorized to charge all required fees, except for the Issue Fee and the Publication Fee, to Deposit Account No. 19-4880. Please also credit any overpayments to said Deposit Account.

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